Conservation Advisory Council Agenda

Virtual meeting

Wednesday, May 17, 2023

1:30 – 3:30 p.m.

Zoom meeting registration link:
https://us06web.zoom.us/meeting/register/tZUtdeCspz0jEtKUGikHr0sLyxwHh2jvquML

1:30 Welcome and Introductions

1:35 Draft Community Agreements *(review)*
The council will review and revise the draft community agreements, prepared by staff after the council's discussions at the February and April meetings.

Presenter: CAC Facilitator Hannah Cruz

1:50 Residential Income Eligibility Refinements *(inform)*
Staff will provide an update on the income ranges used to provide enhanced incentives for residential customers with moderate incomes.

Presenter: Sr. Residential Program Manager Marshall Johnson

2:05 New Homes Program and Billing Analysis *(discuss)*
Staff will present the findings of a recent impact evaluation of the EPS New Construction program, which found participating homes are not performing as well as expected. Staff will engage the council in a discussion about the interpretation of the evaluation and the next steps for the program. **To prepare for this discussion, the meeting packet includes as pre-reading material the executive summary and staff's response to the evaluation.**

Presenters: Residential Program Manager Scott Leonard and Sr. Planning and Evaluation Project Manager Dan Rubado

2:50 Break

2:55 HB 2531 Update *(inform)*
Staff will provide a brief update on the status of HB 2531, a bill pending in the Oregon legislature that would prohibit the sale or distribution of certain types of lighting.

Presenter: CAC Facilitator Hannah Cruz

3:00 New Buildings Program Update *(discuss)*
Staff will provide an update and seeks council discussion on New Buildings program design changes in light of commercial code updates and a current OPUC cost-effectiveness exception.

Presenter: New Buildings Program Manager Shelly Carlton

3:25 Member Announcements, Suggestions for Future Meetings, Public Comment

3:30 Adjourn

Meeting materials (agendas, presentations and notes) are available online.
Next meeting is Wednesday, June 28, 2023, 1:30 – 4 p.m. We will hold a hybrid CAC meeting after a CAC/DAC/RAC lunch and social from 11:30 a.m. – 1:30 p.m. Times may shift slightly as we finalize the details and location for the social. We'll end the CAC meeting no later than 4 p.m. and you can attend virtually or at the Energy Trust office (421 SW Oak St, Suite 300, Portland, OR).

Savings Within Reach

Conservation Advisory Council

May 18, 2023

EnergyTrust of Oregon

Agenda

- About Savings Within Reach
- Legacy income guidelines
- Current income guidelines
- Income qualified programs in Oregon
- Q & A

Savings Within Reach (SWR)

- Introduced in 2009 to provide additional support for customers to and include customers that do not qualify for low-income weatherization programs and face financial barriers to complete energy efficiency upgrades.
- Trade delivered offer
  - Incentives paid directly to trade ally and provided as a discount on customer invoice to reduce out-of-pocket costs
- Increased cash incentives for customers with moderate-incomes
- Complimentary On Bill Repayment (financing fees paid by Energy Trust)
- Income qualification levels also used for Solar Within Reach and EPS Affordable Home bonus

Savings Within Reach incentives

- Detached Single Family Homes
- Manufactured Homes
- Multifamily Homes (attached residential properties) including:
  - Duplexes, triplexes and fourplexes
  - Attached side-by-side structures, such as a townhome or rowhouse
  - Ductless Heat Pump incentives also available for stacked structures with five or more units

Tiered Incentive Structure

Highest incentives reserved for community agencies reaching underserved customers, including low-to-moderate income, rural customers, and communities of color.

Includes No-Cost offers (DHP, insulation)

Set of increased incentives for low-to-moderate income customers delivered by trade ally contractors.

Affordable financing option available with on-bill repayment option.

Standard incentive amounts available to all customers.

Aligns with enhanced rental incentives

2023 Savings Within Reach incentives

Energy-efficiency upgrade	Standard Energy Trust incentive	Savings Within Reach incentive
Attic insulation*	$1.25/sq. ft.	$1.50/sq. ft
Wall insulation	$0.50/sq. ft.	$0.75/sq. ft.
Floor insulation	$0.50/sq. ft.	$0.75/sq. ft.
Ductless heat pump	$500	$1,000
Efficient Heat pump (replacing electric forced–air furnace)	$700	$1,000
High-efficiency gas furnace*	No incentive available	$1,000

Income Requirements

- Households below SWR minimum qualify for Weatherization Assistance Program funding, based on 200% Federal Poverty Level (FPL)
- Income range was initially 200-265% FPL
- Since 2015:
  - **Minimum**: Aligns with maximum income guidelines for low-income weatherization assistance programs set at or below 200% of Federal Poverty Level based on household income and household size
  - **Maximum**: Aligns with the moderate-income limit as defined by the State of Oregon. The Oregon moderate income maximum is defined in the Affordable Housing Covenants as 120 percent of state-wide median income
- Solar Within Reach incentives use this same income range

Updated Income Requirements

Household	2023 FPL	2023 Updated SWR Minimum	Current SWR Minimum	2023 Oregon SMI	2023 Updated SWR Maximum	Current SWR Maximum	Updated vs Current Maximum
1 person	$14,580	$29,160	$27,180	**$52,108**	$62,530	$58,688	$3,842
2	$19,720	$39,440	$36,620	**$68,142**	$81,770	$76,744	$5,026
3	$24,860	$49,720	$46,060	**$84,175**	$101,010	$94,802	$6,208
4	$30,000	$60,000	$55,500	**$100,210**	$120,252	$112,860	$7,392
5	$35,140	$70,280	$64,940	**$116,243**	$139,492	$130,918	$8,574
6	$40,280	$80,560	$74,380	**$132,277**	$158,732	$148,976	$9,756
7	$45,420	$90,840	$83,820	**$135,284**	$162,341	$152,362	$9,979
8	$50,560	$101,120	$93,260	**$138,290**	$165,948	$155,746	$10,202

- Updated requirements will go into effect July 1, 2023, to align with revised Oregon state median income (SMI) levels provide by US Health and Human Services Poverty Guidelines and used in low-income weatherization programs through community action agencies

Oregon Income Qualified Programs

Program	Administering Org	Income Qualifications
HEAR	ODOE	150% or 80% Area Median Income
Community Heat Pump Deployment Program	ODOE	Income is one of many Environmental justice communities as defined in ORS 469A.400 prioritized by the program
Rental Heat Pump Program	ODOE	100% State Median Income (SMI)
Community Action Weatherization Assistance Programs	Oregon Housing and Community Services (OHCS)	200% Federal Poverty Level (FPL)
Utility bill discounts	PGE, PAC, NW Natural	Tiered discounts based on 0-60% SMI
Utility bill discounts	CNG	Tiered discounts based on 0-60% SMI
Utility bill discounts	Avista	Tiered discounts based on 0-60% SMI
Residential/SMF: SWR, OBR, MHR	Energy Trust	Minimum: 200% FPL, Maximum: 120% SMI
No-Cost DHP CRP	Energy Trust	60% SMI
Hybrid HVAC Pilot	Energy Trust	TBD
Portland Clean Energy Fund	City of Portland	<80% AMI; 81-120% AMI; 121-150% AMI
Solar Within Reach	Energy Trust	Minimum: 200% FPL, Maximum: 120% SMI
EPS New Con Affordable Home	Energy Trust	Minimum: 200% FPL, Maximum: 120% SMI

Q & A

- Would the CAC be interested in learning more about income qualified programs in Oregon?
- What elements or insights might you like to discuss in more detail at a future CAC?

Thank you

Marshall Johnson, Sr. Program Manager
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Energy Trust of Oregon

New Homes Impact Evaluation 2012-2019

CAC Meeting

May 17, 2023

EnergyTrust of Oregon

Agenda

- EPS New Construction program background
- Evaluation methods and summary of findings
- Evaluator’s recommendations & staff response
- 15 min discussion

EPS New Construction Program Background

EPS New Home Construction

- Encourages building beyond code with EPS™ requirements
- Works with builders, contractors, architects and third-party verifiers
- Offers EPS support, technical assistance, marketing materials and cash incentives for trade ally builders and owner-builders
- 100% file and 5% field QA

The average EPS home is over 20% more efficient than a typical newly built home.

New homes customers and support

- Builders/developers (approx. 300/annually)
  - Production
  - Custom
  - Owner/builders
  - Wildfire rebuilding
- Verifiers (approx. 40/annually)
- Subcontractors
  - Bi-lingual training & technical support
- Homeowners/sales
  - Education
- Workforce development

Participation process

Before Construction	Builders assemble project team, including program verifier
	Builders make design selections
	Builders pull permits
During Construction	Builders install measures
	Verifiers conduct field quality assurance on all homes
	Program conducts field quality assurance on sample of homes
After Construction	Verifier develops and submits energy models
	Program reviews energy models and requests corrections
	Program queues incentives to the builder and verifier

Program savings claims

- Program home characteristics and efficiency features entered in energy simulation software
  - Assumptions about occupancy, plug loads, and other factors entered
  - Software outputs weather normalized annual gas and electricity usage estimates
- Minimally code compliant version of program home created in simulation software
  - Same basic characteristics and assumptions used, with lower efficiency levels (“code reference home”)
  - Software outputs gas and electricity usage estimates
- Energy savings computed as difference between program and code home usage estimates

Energy Trust new homes offerings timeline

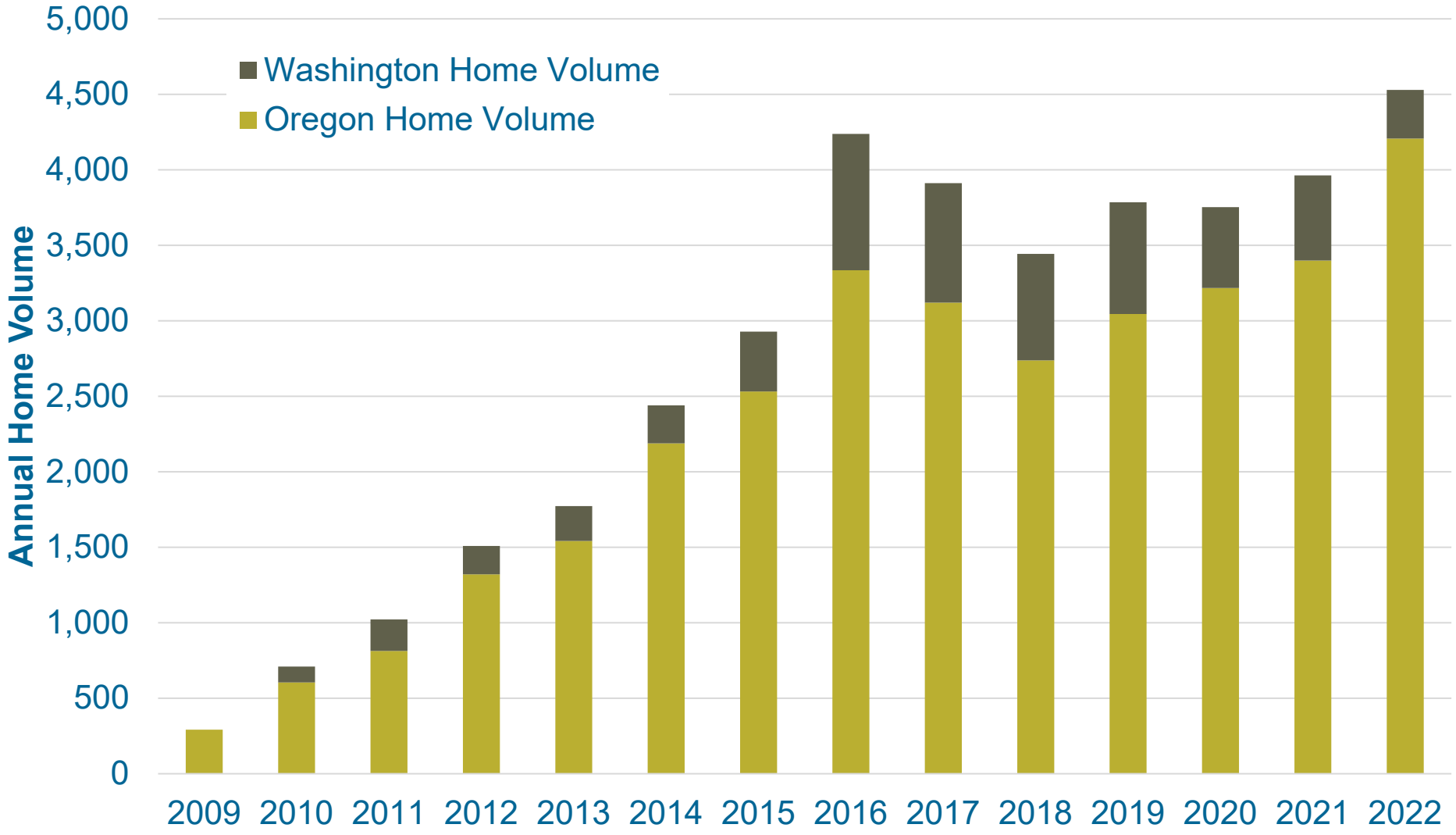
- 2006: Launched first offering for new homes (ENERGY STAR BOPs)
- 2009: Launched EPS whole home offering, with additional stand-alone incentives
- 2014: Began using AXIS database
- 2016: Launched EPS in SW Washington
- 2018: Increased collaboration with code stakeholders
- 2020: Launched tankless stand-alone incentive
- 2020: Launched net zero and energy smart home offerings

Oregon Residential Specialty Code

- Oregon Building Codes Division
- EPS Public Dataset
  - Over 20,000 EPS homes, anonymized data
  - Provided annually to Oregon Building Codes Division and stakeholders
- Data to inform code decisions
  - Ex: top-plate air sealing journey 2012 to 2020 (2023 code ACH)

- https://insider.energytrust.org/eps-new-construction-data/

Home volume over time



Evaluation methods and summary of findings

Evaluation Goals

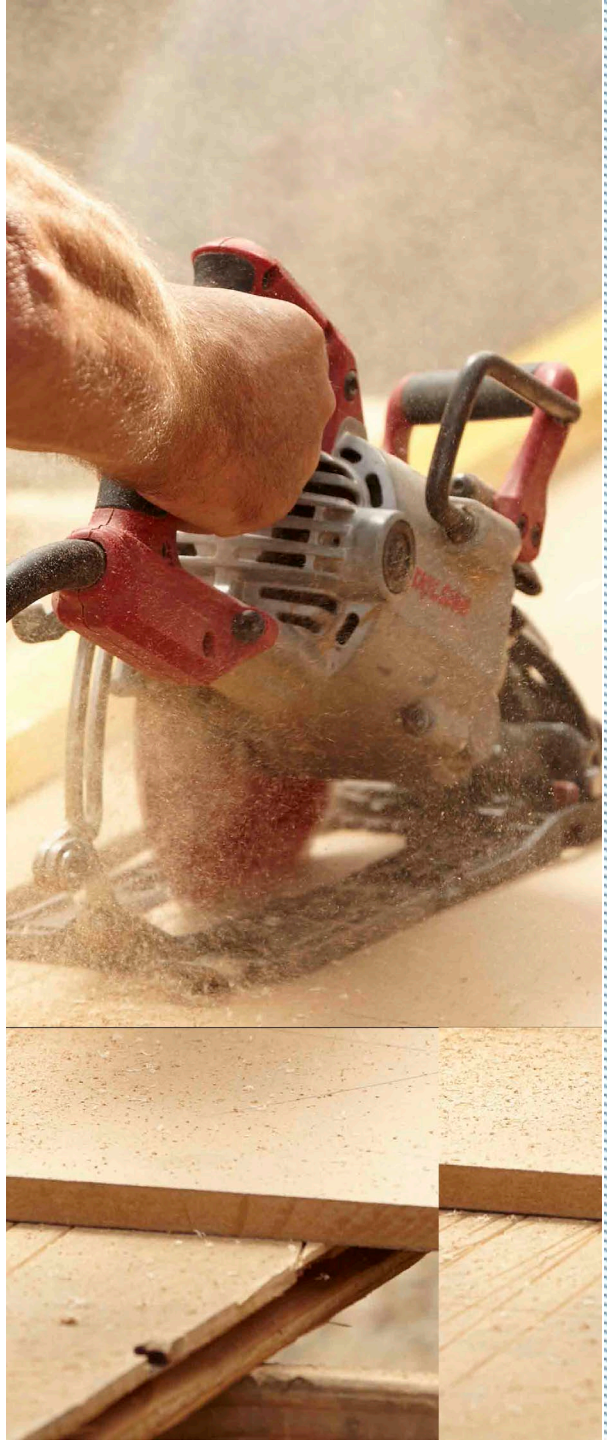
Evaluation objectives to:

- Determine building simulation model accuracy in estimating annual energy usage
  - Program home models
  - Code reference home models
  - Program home savings
  - Program realization rates

- Determine energy savings variances based on home characteristics
  - Space and water heating fuels
  - Year built and energy code cycle
  - Home size
  - Builder type

Evaluation Methods

- Hired Apex Analytics to conduct analysis in 2022
- Obtained program data and identified program homes, characteristics and energy model outputs
- Matched program homes to similar, non-program homes selected from tax assessor data
  - Five matches selected per program home
  - Represent assumed baseline code homes
- Matched all homes to utility billing data
- Computed “actual” weather normalized electricity and gas usage for program and matched non-program homes
- Assessed simulation model accuracy by comparing:
  - Program home actual to simulated energy usage
  - Non-program home actual energy usage to matched code reference home simulated energy usage
- Computed savings and realization rates by comparing actual energy usage between program and non-program homes



Interviews

- Conducted interviews with program staff, verifiers, and builders
  - Discussed findings to help interpret and explain them
  - Reviewed potential drivers influencing model accuracy and savings realization rates
  - Identified hypotheses explaining variances between expectations and results

Summary of Findings (1)

- Building simulation modeling does not accurately reflect actual energy use for program or non-program homes
  - Program homes use more energy than predicted
  - Non-program homes use less energy than predicted
- Program homes save energy, though less than expected
  - Program has a relatively low savings realization rate (RR) when comparing program and non-program home performance
  - 18% electric RR and 21% natural gas RR overall
- Household attributes drove some, but not all, differences between evaluated and reported savings
  - Some groups had higher RRs, but none were aligned with reported savings
  - No clear patterns in RRs for different subgroups or fuel scenarios—seem to vary somewhat randomly with respect to home characteristics

Program Home Actual vs. Modeled Energy Usage

State	Fuel	System Type	Code Version	Number of Homes	WxN Usage	Simulated Usage	WxN Usage vs. Simulated
OR	Electricity	All Electric	OR2017	139	10,422	8,747	**19%**
		All Gas	OR2017	1,070	7,305	6,124	**19%**
		Gas Heat Non-Gas WH	OR2017	634	8,735	6,637	**32%**
	Gas	All Gas	OR2017	1,347	582	478	**22%**
		Gas Heat Non-Gas WH	OR2017	694	338	295	**15%**
WA		All Gas	WA2015	1,800	518	393	**32%**

Non-Program Home Actual vs. Modeled Energy Usage

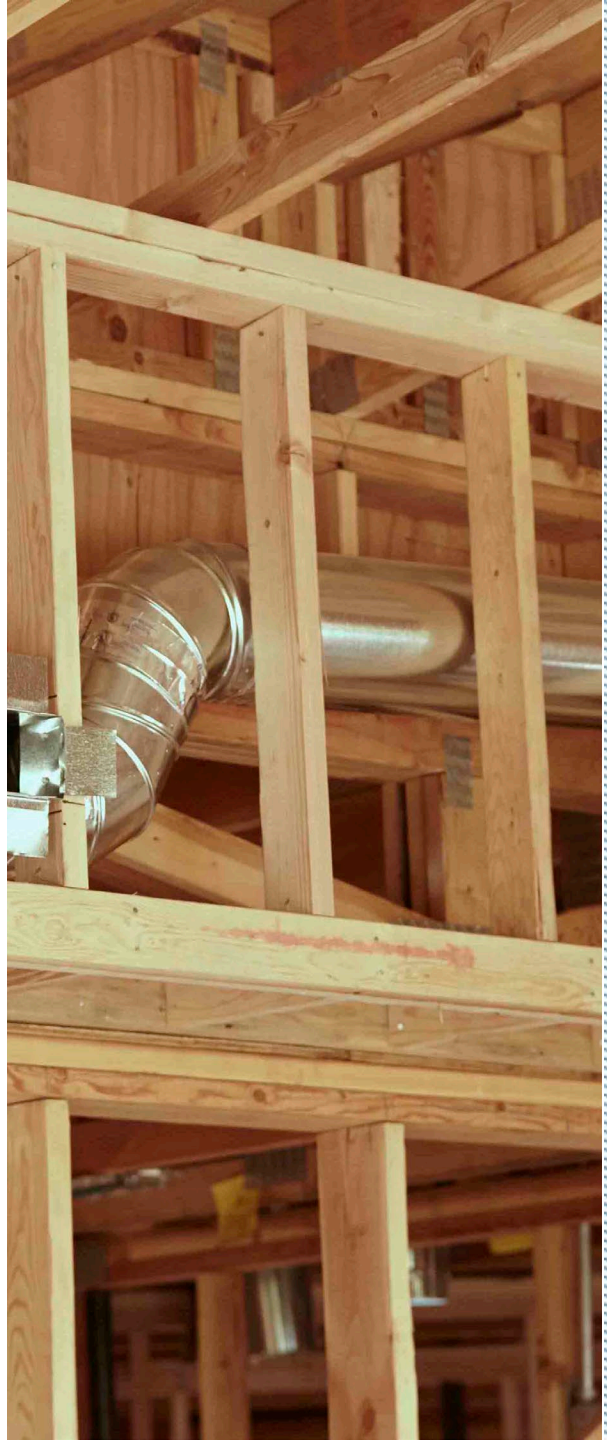
State	Fuel	System Type	Code Version	Number of Homes	WxN Usage	Simulated Usage	WxN Usage vs. Simulated
OR	Electricity	All Electric	OR2017	324	10,417	12,230	**-15%**
		All Gas	OR2017	2,706	7,669	6,720	**14%**
		Gas Heat Non-Gas WH	OR2017	1,159	8,893	8,861	**0%**
	Gas	All Gas	OR2017	3,585	621	697	**-11%**
		Gas Heat Non-Gas WH	OR2017	1,271	310	399	**-22%**
WA		All Gas	WA2015	4,478	562	498	**13%**

Actual Energy Usage in Program vs. Non-Program Homes

State	Fuel	System Type	Code Version	Number of Homes	WxN Savings	Simulated Savings	Realization Rate
OR	Electricity	All Electric	OR2017	139	-5	3,483	0%
		All Gas	OR2017	1,070	364	596	61%
		Gas Heat Non-Gas WH	OR2017	634	159	2,223	7%
	Gas	All Gas	OR2017	1,347	39	219	18%
		Gas Heat Non-Gas WH	OR2017	694	-28	104	-27%
WA		All Gas	WA2015	1,800	44	105	42%

Summary of Findings (2)

- Low RRs may have resulted from many factors
  - Building simulation model calibration issues
  - Uncertainty around occupancy, behavior, added end uses, and other model assumptions
  - Program tracking errors input into models
  - Heat pump water heater performance issues
  - Program verifiers fudging model inputs to achieve desired outcomes
  - Program spillover effects on non-program home construction practices
- Studies in other states have found evidence for spillover from new homes programs



Recommendations & Staff Response

Recommendations & Staff Response (1)

Recommendation to improve savings estimates: Examine annual energy use of new homes built during the same timeframe but in other communities outside of program areas.

- Implicitly recommends that Energy Trust should determine energy savings using a market baseline by comparing energy use in program homes to those built outside the program, rather than strictly to code
- New homes market is a special case, due to long-term impacts of Energy Trust and NEEA efforts on codes and building practices in Oregon
- EPS program should continue using current energy code as the baseline
  - Continue creating simulation models of minimally code compliant versions of program homes to use as baseline
- However, program must calibrate simulation models and adjust modeling process to align with current home conditions and observed performance

Recommendations & Staff Response (2)

Recommendation to measure market effects: Energy Trust may consider additional research to help identify market effects and how influential program has been in advancing above-code construction.

- Market research is necessary to confirm influence of the program and NEEA on market transformation and residential energy codes
- If existing evidence and research on market transformation influence is insufficient, Energy Trust will conduct follow-up research in 2024
  - Interviews with a variety of market actors to help establish program influence on market
- May conduct field research to verify code compliance and above-code building practices in program and non-program homes
- Develop more formal market transformation strategy and logic model to ensure it continues pushing new construction market and codes

Recommendations & Staff Response (3)

Recommendation to address some of the program-side drivers behind savings realization rates: Energy Trust should conduct internal review and validation of the process associated with AXIS database data entry and program verifiers.

- Program will review processes for reviewing and validating data collected on-site by verifiers and entry into AXIS database
- Consider enhanced quality assurance for a time, to confirm key model inputs
- Improve accuracy of energy savings estimates by calibrating simulation models based on energy use reported for 2017 code cycle
  - May involve adjustment factors on simulation outputs or changes to model assumptions
- Analyze data for recently built homes in RBSA and align key model inputs and assumptions
  - More accurate assumptions should reduce modeling errors in simulated energy usage

Recommendations & Staff Response (4)

Recommendation to adjust the assumed baseline "code" home: If program is unable to find evidence of substantial market transformation impacts, Energy Trust may consider calibrating REM/Rate models with reported energy use.

- Implies that market baseline should be used if evidence of program's market transformation effects cannot be found
  - We agree we must consider transitioning program to use market baseline if follow-up research does not confirm the program's role in transforming the market
- Baseline energy usage would be determined from non-program homes, like the matches used in this study
  - Might involve calibrating models or applying adjustment factors based on this study

Recommendations & Staff Response (5)

Recommendation to evolve and futureproof the program. Consider alternate program design opportunities to advance building practices beyond current program requirements.

- Program will continue to evolve its offerings and services to stay ahead of advancing codes
  - Work has already started with inclusion of new offers such as net zero, battery storage, electric vehicle ready, etc.
- Continue to introduce and promote new efficiency measures to the market
- Consider adopting more prescriptive measures focused on specific systems to help reduce complexity and improve cost-effectiveness
  - Evidence suggests some builders may be responsive to more targeted offers for specific technologies and practices
- Increase market transformation activities to continue pushing entire market and ultimately codes

Dan Rubado, Sr. Project Manager – Evaluation
Scott Leonard, Program Manager - Residential

EnergyTrust of Oregon

Energy Trust of Oregon Impact Evaluation of the New Homes Program 2012–2019

Submitted by Apex Analytics LLC

April 11, 2023

MEMO

Date: 4/13/2023
To: Energy Trust Board of Directors
From: Dan Rubado, Sr. Project Manager – Evaluation
Fred Gordon, Director of Planning and Evaluation
Scott Leonard, Program Manager – Residential
Subject: Staff Response to the 2012-2019 New Homes Billing Analysis

Apex Analytics completed a billing analysis of homes that received support for above-code energy performance from Energy Trust's New Homes program. The analysis showed systematic errors in the simulated energy use of program homes and much lower than expected energy savings, when evaluated against a matched comparison group of similar, non-program homes. Not only did the program homes use more energy than expected from the simulations, but their non-program counterparts used less energy than expected. This resulted in a relatively narrow gap between program and non-program home energy usage, equating to low energy savings and realization rates. These results indicate the program's impact on individual new construction projects is relatively small. This is partly due to the unexpectedly high performance of homes not affiliated with the program, indicating they may have been built above the energy code standards at the time of construction. Another interpretation is the program's simulation models, and the embedded assumptions about how builders comply with code, are not accurately modelling the choices builders make in practice. Since non-program homes are performing better than expected, it is more difficult for program homes to exceed this elevated baseline. However, this conclusion does not recognize the nearly two-decade history of the program in influencing the market and working with code officials to advance residential energy codes over several code update cycles.

The program has a strong relationship with the Oregon Building Code Division and has worked closely with officials to provide information and recommendations about code updates. These activities, combined with the program's project level impacts, have influenced the code and the entire residential new construction market to create market conditions where program and non-program homes are being built to relatively high levels of performance. Part of the stated purpose and justification for the New Homes program is to transform the residential new construction market, which will be cost-effective over the long run, even if individual projects are not in the short run. With that perspective in mind, we have the following responses to Apex's recommendations for the New Homes program.

1. ***Recommendation to direct downstream savings impacts of the program.*** *Future efforts may consider examining the annual energy use of new homes built during the same timeframe but in other communities outside of program areas*.

   At the core of this recommendation is an assertion that Energy Trust should determine the energy savings claims for program homes using a market baseline by comparing energy use in program homes to those built outside the program. While this makes sense in many markets, and is consistent with Energy Trust guidelines, the new homes market is a special case due to the integral impact of Energy Trust's and the Northwest Energy Efficiency Alliance's (NEEA) efforts on codes and practice in Oregon.

Counter to Apex's recommended approach, we believe the New Homes program should continue using the current energy code as the baseline against which energy savings are measured and claimed for participating homes.

The program's activities over the past two decades have allowed the current energy code to become as stringent as it is today and have helped builders both meet and exceed energy codes. Energy Trust provides data to stakeholders involved in the code development process, to indicate whether the construction industry is ready to adopt above-code building practices into the next code, based on adoption rates in Energy Trust programs. The program has also introduced new measures and building techniques into the market, widely promoted efficient practices to make them more common, worked with code officials to adopt new requirements and supported builders to meet and exceed new requirements after new codes are adopted. Without this support, new homes would not only fall short of the current energy code, we believe the energy code itself would be a much lower bar. Therefore, all energy performance improvements in program homes beyond the energy code can be attributed to the program, either through its direct influence on individual projects, or its broader influence on shifting the codes and market over time. As such, Energy Trust should continue to use the energy code as the baseline when claiming savings for New Homes projects.

In practice, this means the program should continue to create an energy simulation model to estimate the energy use of each program home. Then a separate simulation should be specified as minimally code compliant and compared to the as-built simulation to estimate the difference in energy usage. This course of action is contingent on calibrating the energy simulation models used by the program and adjusting the energy modeling process to better align with current conditions and the observed energy performance, as described in more detail below. As an alternative path, the program is expanding its prescriptive measure portfolio to use in place of energy simulations, estimating savings for each efficiency measure above the code requirements for individual systems. This approach does not capture the nuances of individual homes, nor account for interactions between measures, although it avoids many of the pitfalls of simulation models described in this report, as well as the administrative burden of the energy simulation process.

2. ***Recommendation to support market effects.*** *Energy Trust may consider additional research to help identify market effects and how influential the program may be in advancing above-code construction.*

   We agree that market research is necessary to confirm the influence of the New Homes program and NEEA on market transformation, residential energy codes and the degree to which they have been transformed. If existing evidence and research on market transformation influence is insufficient, Energy Trust's Evaluation team will conduct follow-up market research in 2024 for this purpose. This would include interviews with a variety of market actors, including those who work outside of the program, to help establish how much the program's activities and the building practices it promotes have influenced market actors and code updates over the years. However, we do not see value in pursuing additional research related to building practices in states that have no residential new construction programs to create a point of comparison to building practices in Oregon. There are too many differences between states – from climates and building codes and regulatory environments – to obtain any reliable or actionable information from such an exercise.

We will consider conducting field research to verify code compliance and above-code efficiency measures and building practices in program and non-program homes. However, we foresee this type of field research being costly and it may not provide much additional value to Energy Trust in making a market transformation case, although it may be useful for improving the accuracy of energy simulations. A less costly alternative would be to consult data from NEEA's forthcoming Residential Buildings Stock Assessment (RBSA) to determine newer homes' relative energy performance and whether they are likely to meet or exceed the energy code.

If follow-up research confirms the program's role in helping to transform and shift the residential new construction market, this will provide further support for our assertion that we use the current energy code as the baseline for program homes when claiming savings. In addition, the program will develop a more formal market transformation strategy and logic model to ensure that it is positioned to continue pushing the new construction market and code towards higher efficiency.

3. ***Recommendation to address some of the program-side drivers behind savings realization rates.*** *Energy Trust should conduct an internal review and validation of the process associated with AXIS database data entry and program verifiers.*

   We agree the program needs to improve the accuracy of its energy savings estimates. However, part of the poor realization rates found in the evaluation may be due to non-program homes being built more efficiently than required by code. The energy simulation models used as the basis for these savings claims consistently underestimate energy use in program homes and slightly overestimate it for the code-built baseline. The New Homes program will calibrate the simulation models based on the energy use values listed for the most recent code cycle (2017) in this report. This may involve applying adjustment factors to simulation outputs or making adjustments to model assumptions.

   Energy Trust will analyze data for recently built homes in the forthcoming RBSA and align key model inputs and assumptions with RBSA results. This exercise should include inputs that are not known prior to occupancy and therefore not available to program verifiers during the simulation modeling process, such as number of occupants, occupancy schedule, presence of air conditioning, major plug loads (like hot tubs, freezers, etc.), thermostat temperature set points and schedule, and other drivers of home energy use. Inputting more accurate assumptions into the model should reduce the discrepancy between modeled and observed energy usage, on average. In addition, the program may need to make adjustments to the simulation models, or add correction factors to the outputs, to better account for interactive effects, especially with heat pump water heaters or similar equipment. Depending on where and how heat pump water heaters are installed in homes, they could have much larger space heating penalties than assumed in the simulation models, which could at least partly explain the low realization rates we observed in gas heated homes with electric water heating.

   Lastly, the program should review its processes for reviewing and validating data collection on-site by program verifiers and entry into the program's AXIS database. There may be points in this process where characteristics are incorrectly recorded on-site, data are incorrectly entered into the database, the program does not have sufficient visibility or oversight, the simulation software is using inappropriate default values, or there are errors in the simulation model itself. This review should include how data are captured, how quality control is conducted, and how the simulation models are

specified and run. In addition to program processes, a review of technical processes with the database and modeling vendors may be necessary.

The program will consider conducting enhanced quality assurance for a time, to confirm certain key model inputs, especially in gas heated homes. This is in response to the findings in the report that program verifiers may be incorrectly recording the water heating fuel for some gas heated homes, and that other simulation model inputs may be incorrectly entered by verifiers. Enhanced quality assurance may include requiring verifiers to photograph the water heater and nameplate, along with other efficiency measures, or program staff could accompany program verifiers on home inspections to check that the water heater type and other parameters are recorded correctly. It may make sense to validate other key inputs while on-site.

4. ***Recommendation to adjust the assumed baseline "code" home.*** *If the program is unable to garner sufficient evidence to support substantial market transformation impacts, Energy Trust may also consider taking steps to calibrate the REM/Rate models with the energy use values reported here.*

   As noted above, if follow-up research finds that the New Homes program has not been pivotal in transforming the new homes market and the residential energy codes, then Energy Trust must consider transitioning the program to use a market baseline. In practice, this would involve calibrating the assumed energy usage of the baseline code homes to be in line with what was observed in this study for non-program homes. This could involve applying an adjustment factor to the code home simulation model outputs or adjusting the input parameters to achieve a similar outcome.

5. ***Recommendation to evolve and futureproof the program.*** *Consider alternate program design opportunities to advance building practices beyond current program requirements.*

   We agree with Apex that the program will need to continue to evolve its offerings and services to stay ahead of advancing codes. The program will identify, test, and support emerging advanced building practices and efficient technologies with enhanced incentives and services. This work has already started with the inclusion of new program offers such as net zero, battery storage/electric vehicle ready, and other initiatives, but the program will continue to look at alternative options. The program will help introduce new efficiency measures to the market and promote them to program builders and subcontractors. In addition to introducing more aggressive building techniques, the program may consider adopting more prescriptive measures focused on specific systems. This approach may help the program reduce its complexity and improve cost-effectiveness in the face of an increasing baseline efficiency, increasingly costly efficiency measures, and reduced energy savings. There is also some evidence from the interviews to suggest that some builders may be more responsive to more targeted offers for specific technologies and practices, at this point in the market's evolution.

   In addition, the program will consider how to better position itself as a market transformation program and what new activities it might undertake to continue pushing the entire market and ultimately codes. As stated above, depending on the outcome of new construction market research in 2024, Energy Trust may begin to quantify and claim above-code energy savings occurring in non-program homes, if it is established that the program is pushing the entire market beyond the current energy code. Having a clear market transformation framework will further increase the impacts of the program and add credibility to any market transformation savings claims that are made.

Executive Summary

Energy Trust of Oregon (Energy Trust) has offered performance-based energy efficiency incentives to Oregon home builders through its New Homes program since 2009. Energy Trust expanded the program to builders in Southwest Washington in 2016. To participate in the program builders must become Energy Trust trade allies, going through training and signing participation agreements. The program provides builders with incentives, education, and training, among other support. Participating builders constructed almost 20,000 high-efficiency new homes in Oregon between 2012 and 2019 and 2,000 high-efficiency new homes in Washington between 2016 and 2019.

In early 2022, Energy Trust hired Apex Analytics (Apex) to validate electric and natural gas energy savings resulting from the New Homes program during the 2012–2019 timeframe. To estimate annual energy use, Apex followed a similar approach as previous studies, comparing energy usage from weather normalized billing data for program homes to energy use estimated by REM/Rate building simulation model. In addition, Apex purchased statewide assessor data to develop a matched comparison group of non-program homes, matching non-program homes to program homes based on closest geographic distances, square footage, and HVAC heating system types. The matched non-program homes served two purposes: to compare as-built conditions of non-program homes to reference homes used for REM/Rate simulation models, and to calculate energy savings by comparing weather normalized energy use of the program and matched comparison non-program homes.

To help draw supporting insights about the program and to identify potential drivers of differences between evaluated savings and program-claimed savings, Apex completed interviews with program and implementation staff, third-party program verifiers, and program trade ally builders. Benchmarking the results and methods from this evaluation relative to other evaluations uncovered additional insights.

The following information summarizes the key research objectives, questions asked, high-level descriptions of the approach, and key findings.

Objective: Determine building simulation model accuracy in estimating annual energy usage.	
Research Question	Approach
Are program homes more efficient than building model estimates?	Compare the actual weather normalized energy use with building simulation modeled energy usage of program homes.
Do building model reference code estimates accurately reflect the energy use of non-program homes?	Compare the actual weather normalized energy use for the matched comparison non-program home with building simulation modeled energy usage for code-built specification of program homes.

Building simulation modeling does not accurately reflect actual energy use for program and non-program homes. This evaluation found that program homes use more energy – and are therefore less efficient – and non-program homes use less energy – and are therefore more efficient – than predicted by the building simulation models.

Objective: Determine building simulation model accuracy in estimating energy savings.	
Research Question	Approach
Do program homes use less energy than homes built outside of the program?	Compare program home actual weather normalized energy use relative to a matched comparison sample of similar homes.
What is the evaluated realization rate of program claimed savings?	Compare energy savings reported by the program relative to evaluated, in both absolute and relative (as a percent of annual load) terms.

Homes built through the New Homes program save energy, though not at levels reported. The weather normalized billing data suggested that program homes use more energy than anticipated, while non-program homes use less energy than building simulation would predict. As a result, program homes save less energy than expected and the program has a relatively low savings realization rate.[1] Overall per home electric savings were 241 kWh versus 1,313 kWh claimed, resulting in a **18% electric realization rate.** For natural gas, overall per home savings were 35 therms versus 165 claimed, resulting in a **21% natural gas realization rate**.

Objective: Determine energy savings variance based on household characteristics.	
Research Question	Approach
Do savings depend on factors like building vintage (year built) or applicable energy code cycle, square footage, space heating fuel, water heating fuel, builder type (large production vs. moderate or low-volume builders)?	Segment the analysis and energy savings results based on household characteristics.

While household attributes may drive some differences in achieved energy savings, they are not sufficient, alone, to drive the discrepancy between measured and reported energy savings. Some groups tended to show higher realization rates than others, though no subgroups had realization rates aligned with program claims. The groups showing the strongest realization rates were moderately priced homes, built to earlier code cycles. Some groups showed higher electric realization rates while either opposite or indeterminate for natural gas, and vice-versa.

Objective: Identify key drivers behind energy use and realization rate differences.	
Research Question	Approach
Are there factors within or external to the program that influence the energy simulation model, energy savings, or building practices across the new homes market?	Conduct series of interviews with program staff, program verifiers, and trade ally builders and benchmark other new homes evaluations.

The low savings realization rate across the New Homes program is a function of a multitude of factors. Factors include building simulation modeling calibration, program tracking errors – especially with hot water fuel type, uncertainty around unidentified occupancy and behavioral characteristics, massaging of model inputs by verifiers, increased demand for energy-efficient homes among consumers in general, and spillover. Evidence from this

[1] The realization rate is the ratio of evaluated savings to claimed savings.

evaluation, from the quantitative impact, the qualitative interviews, and benchmarking, suggest the low realization rates are partly a function of all of these factors. Benchmarked studies have also found substantial evidence for spillover (market effects) from new homes programs.

In light of the findings presented in this study, there are some unresolved questions and recommendations for Energy Trust to consider.

1) **Recommendation to improve direct downstream savings impacts of the program**: **In future efforts, Energy Trust should examine the annual energy use of new homes built during the same timeframe but in other communities outside of program areas**.
    a. The analysis did not include homes built in other communities outside of the areas that included New Homes projects, by design. A benchmarked evaluation conducted for Wisconsin Focus on Energy added non-program groups outside of the program areas and found marginally higher baseline non-program energy use, improving the realization rates.
2) **Recommendation to measure market effects**: **Energy Trust may consider additional research to help identify market effects and how influential the program has been in advancing above-code construction.**
    a. Energy Trust should consider conducting outreach from voices not covered in this evaluation, namely from tradespeople (more broadly) and builders operating outside of the program.
    b. Energy Trust may consider benchmarking states with similar stringent building codes but lacking new homes programs.
    c. Energy Trust may consider collecting primary data through onsite research for program and non-program homes.
3) **Recommendation to address some of the program-side drivers behind savings realization rates: Energy Trust should conduct an internal review and validation of the process associated with AXIS database data entry and program verifiers**.
    a. Energy Trust should also work with PDC and PMC contractors to root out potential hot water fuel misclassifications. The negative savings realization rates for mixed fuel households revealed the potential for data entry errors.
    b. Energy Trust should work with verifiers to learn more about ways the current building simulation process is possibly being massaged to capture deeper, though maybe not realistic, energy savings.
4) **Recommendation to adjust the assumed baseline "code" home**: If the program is unable to garner sufficient evidence to support claiming substantial market transformation impacts, Energy Trust may also consider taking steps to calibrate the REM/Rate models with the energy use values reported here. This could include revising the assumed baseline code home accounting for the lower weather normalized energy use found in this study. The Wisconsin Focus on Energy program is currently adjusting baseline "code" homes in building simulation models after several years and multiple studies attempting to explain lower than anticipated evaluated realization rates.

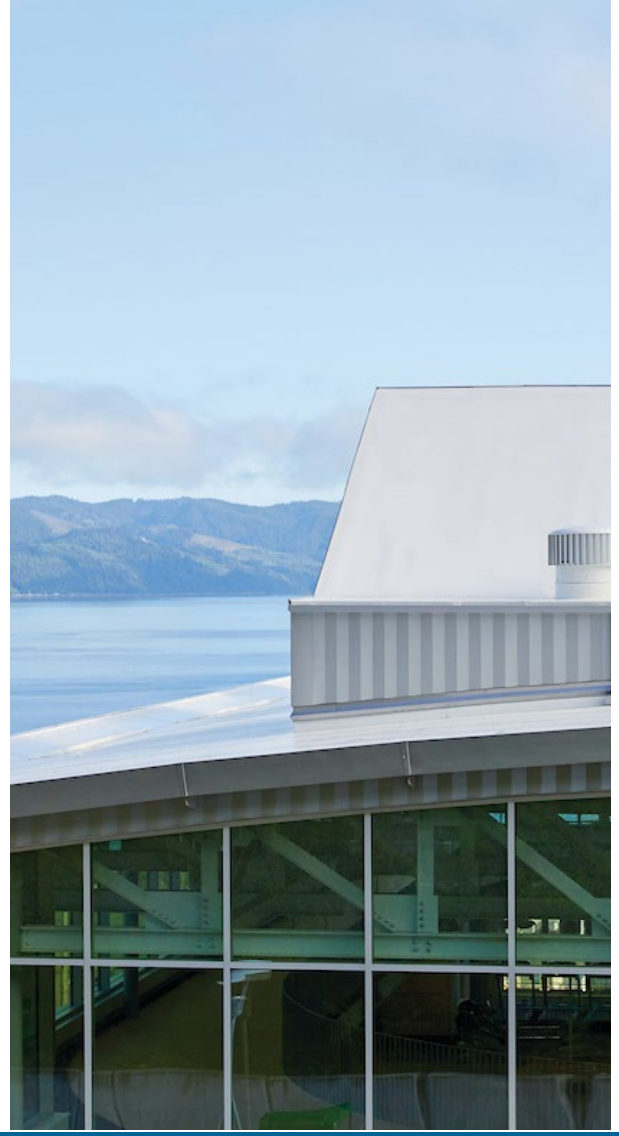
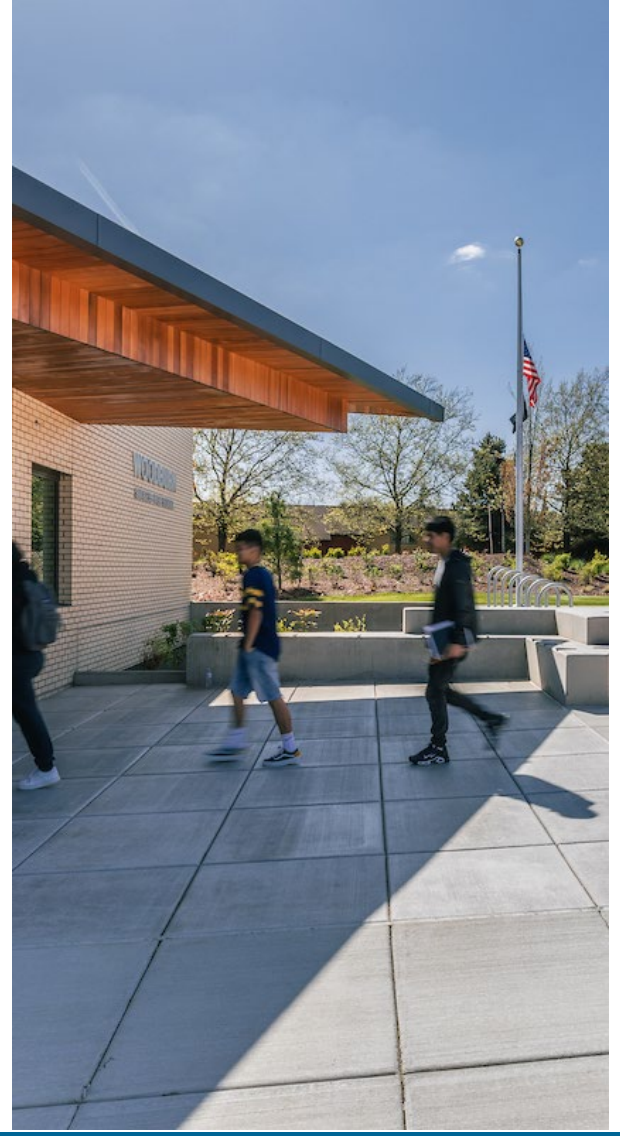
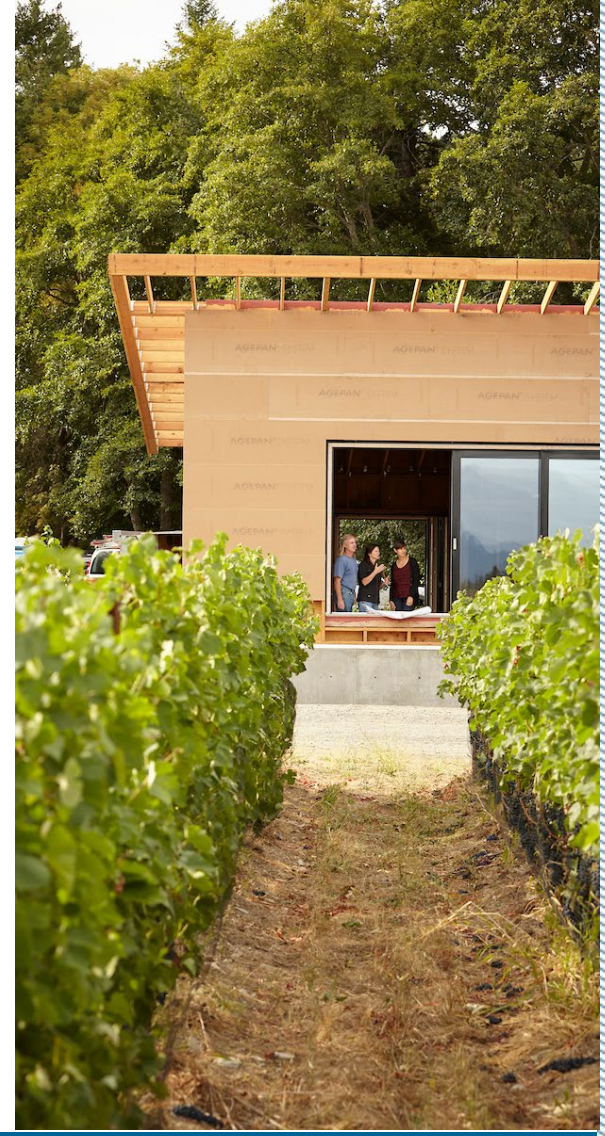
5) **Recommendation to evolve and futureproof the program: Consider alternate program design opportunities to advance building practices beyond current program requirements.**

   a. Energy Trust could help builders stay ahead of the market by advancing higher-efficiency new construction, through pilot offerings, deeper incentives, training and other support, for efforts including net-zero homes, microgrid-enabled communities, passive-house design and developments, or even greater tiered options to exceed current stretch code requirements. These efforts should include establishing baseline building practices and logic models with key performance criteria to support future market transformation claims.

To view the complete report, please visit:

https://www.energytrust.org/wp-content/uploads/2023/04/Energy-Trust-New-Homes-Impact-Evaluation-2012-2019-Final-wSR.pdf

OR navigate to energytrust.org/documents and search for "New Homes Impact Evaluation"

New Buildings Program Design Update

Conservation Advisory Council (CAC)

May 17, 2023

EnergyTrust of Oregon

Context

Program services

Training and Education	Training series Net Zero Grants
Energy Design and Modeling Services	Early Design Assistance Energy Modeling Assistance
Whole building incentives	Custom Whole Building Path to Net Zero
Prescriptive incentives	Technology-based

A brief history of TRC exception for whole building projects

2019-2020

- Code changes made it impractical to identify incremental costs in whole building projects
- OPUC cost effectiveness exception to Total Resource Cost (TRC) test for whole building projects

2020-2021

- Exhausted all options for measure level approach to TRC for whole building projects
- TRC exception extension through March 2024

2022-2023

- Expanding program offers for whole building designs
- Conducted market research
- Continue to influence projects beyond code

Main Areas of work

Convened an internal team with range of expertise and perspectives

Explored ways to cost whole building compared to code baseline

Moved to ASHRAE-based whole building models for savings analysis beyond code

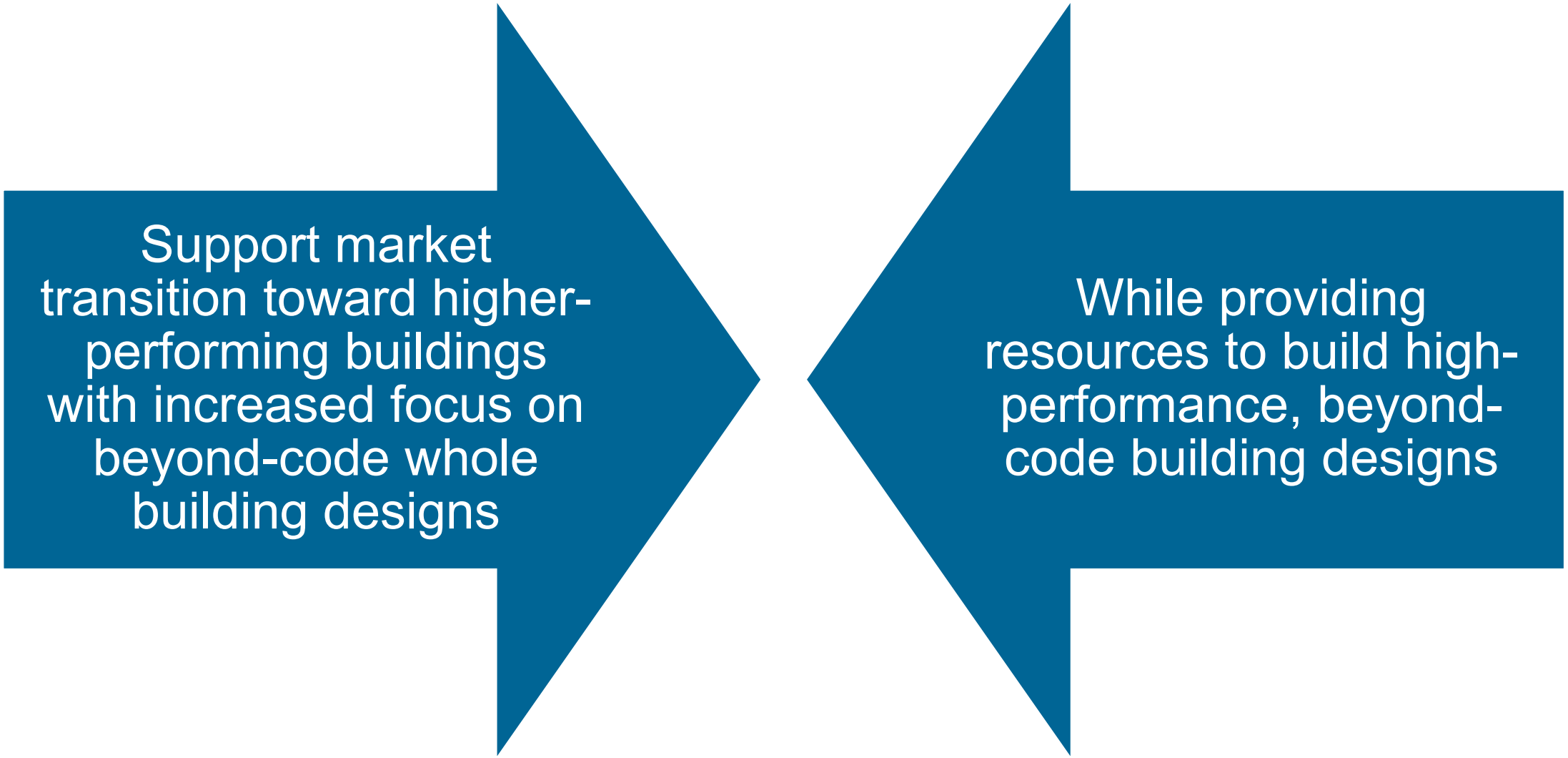
Launched updated Market Solutions for Multifamily

Convened stakeholder group *(NEEA, ODOE, OPUC, Energy Trust)*

Conducted market research

Opportunity & Program Design

Our opportunity



Impact

All of Oregon's new buildings are built beyond code, resilient, comfortable and accessible to all Oregonians

Outcomes

- More beyond-code energy savings
- More project teams using integrated design
- Customers are clearly making cost-informed decisions
- Greater benefits are going to historically underserved communities
- Lower operating costs for building occupants

Activities

- Build and strengthen training partnerships
- Focus content on whole building design strategies
- Increase access to early design assistance and energy modeling services and resources through outreach and professional energy modelers
- Coordinate with NEEA/ODOE on training

Highlights of Research and Program Design Changes

Market research findings

Compared projects 2019-2021 and 2016-2018

- Most projects completed 2019-2021 were pre-ASHRAE
- 50% more projects enrolled in 2019-2021
- Market penetration at 83%, rural share declined

Very high satisfaction rates

- Many appreciate the responsiveness, knowledge and problem-solving skills of outreach staff, as well as their participation in their community
- *"Having a third-party involvement is a value. A third party verifies, or asks questions, it is the collaborative process that makes Energy Trust valuable. They are sounding boards. The incentives are helpful, but the sounding board and collaboration is key"* - Architect of market rate whole building multifamily project

Market research findings

More support to go beyond code

- Market actors are worried that code changes would be too costly for small business owners, especially in rural areas
- Customers reported modeling support gave them the ability to run "what-if" scenarios on various aspects of the design to "examine the project more holistically" than they could have otherwise
- Code officials would like to find ways that Energy Trust could support training for their staff

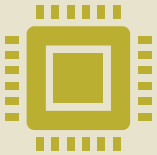
Early engagement is critical

- Energy modeling is what pushes some projects to construct at net-zero level, saying we should emphasize it and provide additional financial support
- Early design and energy modeling are critical support-helping to include solar and convince decision makers to invest in efficiency

Expanding the knowledge base for Whole Building Design

- There was a 30% increase in training participation from 2021 to 2022
- Nearly 20% of attendees are people of color
- Majority of people who attend trainings say
  - They're very likely or somewhat likely to apply the knowledge
  - They received sufficient information to make a cost-informed decision
- Net Zero research focused on cost impacts

Expanding whole building offers to more customers



Customers and projects

Customers who have not been served or would have done system-based

Projects that are smaller/simpler

Simplified whole building models

Simplified Performance Rating Method (S-PRM) developed by PNNL

Focus on schools, office, retail projects that fit criteria

Recap & Discussion

The program vision for whole building projects

- Training, education, and grants that support whole building and integrated designs
- Project-based information that helps customers design high performance buildings
- Additional support, resources and tools for project teams that may not have experience or capacity for design and modeling
- Incentives for driving deeper savings
- Support market alignment with beyond code designs using whole building framework (Appendix G)

To deliver on the opportunity, Energy Trust will:

- Expand our relationships with more architects and engineers and design firms
- Launch and test more offers to expand whole building approach to more customers
- Provide clarity to market on future program designs and direction
- Continue to work with OPUC on approach to whole building cost effectiveness

Questions for CAC

Are the proposed program changes addressing market needs?

Any other questions on the context or program designs?

Questions?

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Recap of Oregon commercial energy code: Journey to ASHRAE

Pre-2019

Before 2019, Oregon code was not based on ASHRAE 90.1

2019

2019 Oregon Zero Energy Ready Code (OZERC)

- Based on ASHRAE 90.1 – 2016
- Released October 2019, grace period through January 1, 2020

2021

2021 Oregon Energy Efficiency Specialty Code (OEESC)

- Based on ASHRAE 90.1 – 2019
- Released April 2021, grace period through September 30, 2021

Draft Community Agreements

Conservation Advisory Council

May 17, 2023

EnergyTrust of Oregon

Why We Use Community Agreements

- At Energy Trust, we are improving how we listen to, serve and provide incentives and benefits to customers we have not centered in the past, including
  - People who identify as Black, Indigenous and People of Color
  - People with low and moderate incomes
  - People living and working in rural areas
- We will be adding more customer and community perspectives to CAC that can elevate the experiences of these customers. With more cross-cultural differences, there is more room for miscommunication, disagreement and even harm
- **Agreements set the tone for the experience of being on the CAC, including how we will behave, communicate and participate.**
- **They are a tool for the facilitator and members to use to address misunderstandings and harm when it occurs**

Notes from April Group Share-out

- **Importance of trust:** came from meetings and small groups that went well; trusting framework and facilitation; investing upfront in small groups and meetings to get to know each other, really pays off in the end, especially when **healthy conflict** is needed or there is contentious subject matter; trusting that our facilitators will ensure this occurs
  - Personal sharing can be too much for some people: can feel uncomfortable; explore more how to build trust in this virtual world while not veering always into the personal lane
- Recognizing this group has **wide variety of experience, backgrounds**: helpful to have summaries, pros/cons, background information, relevance for the various groups and represented entities; anything to help the people with wide variety of backgrounds engage
- Supporting the moderator: we're all working together on this; example, if one person is dominating, then others in the group **speak up and interject their ideas**; the group helps each other and the moderator keep to the agreements
- Clear expectations and clear next steps: example, pre-reading is highlighted
- Importance of a strong facilitator: meetings that went well characterized by **participation by all**, with energetic discussion; vs. listening and listening to 1-2 people over and over; to get to dynamic discussion, strong facilitator needed and requires preparation
- **Different styles and comfort levels to provide feedback** in large virtual meetings: utilize more virtual meeting tools (e.g., pulse survey)
  - Open door – **can contribute in meeting or out**
- Body language and importance of in-person meetings sometimes
- Respect for people's time: more about using the time up that is needed, using time effectively, not meeting or using all the time

Draft Community Agreements: We will…

- Stay engaged
- Share the stage / step up, step back
- Listen to each other to learn and understand
- Assume best intent and attend to impact
- Address actions that marginalize or harm another person

*What **behaviors** are needed to have a council where there is*

- ❑Trust
- ❑Healthy conflict
- ❑Respect for a variety of experiences and backgrounds
- ❑Engagement and participation
- ❑Support for one another
- ❑Participation, in different ways, inside/outside meeting

Take-aways for the Facilitator, Presenters

- Use multiple ways to gather feedback: verbal, written, during/after meeting, pulse surveys, other tools
- Stay flexible
- Cultivate an engaging and open forum that accepts healthy conflict and different contribution styles
- Find ways for members to connect and get to know each other, including in-person
- Provide summaries, pros/cons, background on agenda topics
- Set clear expectations: for discussions, pre-reading, next steps

Take-aways for Council Members

- There are no experts
- Utilize the many ways to give feedback: verbal, written, during/after meeting, taking the surveys
- Prepare for meetings, like when pre-reading is provided
- Be present

Building Trust and Connection

To build trust, we need to know each other!

- Check-in questions
- Member updates
- Small group work
- Social time
  - June and October meetings
- Other or more?

Next Steps & Thank You

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EnergyTrust of Oregon